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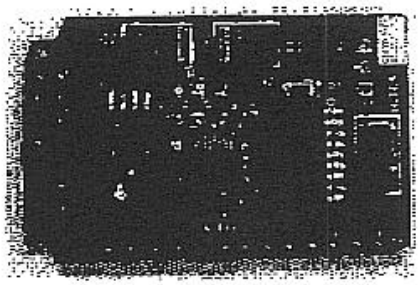
Jameco Part number 157981

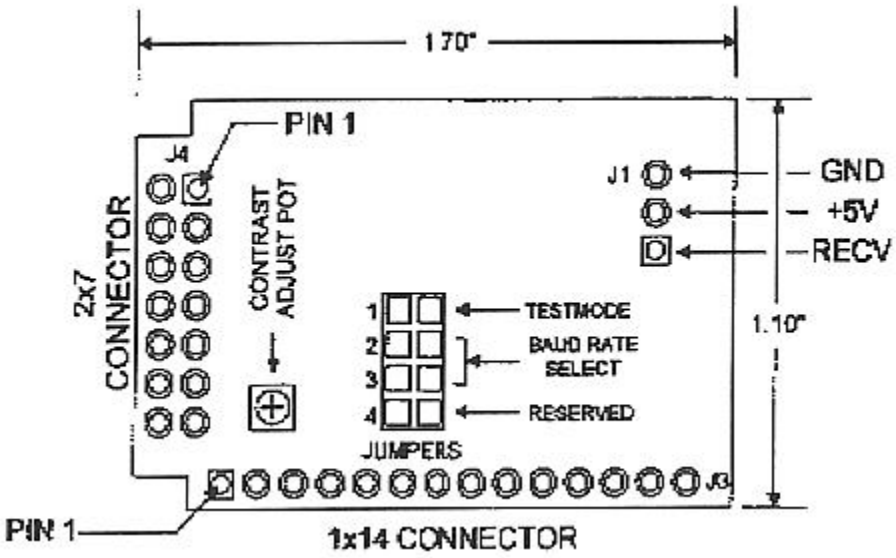
LCD SERIAL INTERFACE MODULE USER'S MANUAL

Introduction:
The LCD Serial Interface Module converts a serial stream of characters to the format required by the Hitachi 44780 LCD controller device. ASCII characters and control code are processed by the module and formatted into module specific commands. The SIM module interfaces with both the 1x14 or the 2x7 I/O connectors located on the LCD



module. Pin 1 is denoted by the square pad.

LCD SIM (actual size)



LCD CONNECTOR PLACEMENT

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SIM Setup

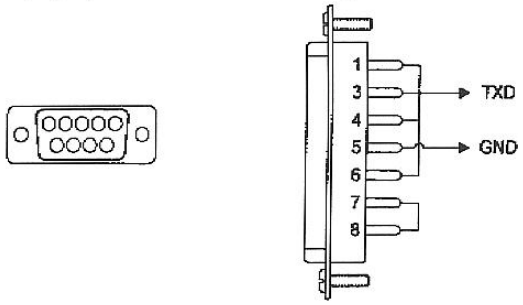
J1 provides the SIM module with the RS-232 Serial Input, +5V, Ground. The connections for J1 are as follows:

Pin Number	J1 Signal Description
1	Serial Input or Receive (RECV). This pin connects to the transmit line of your RS-232 connection. *(Note: Pin 1 is denoted by a square pad).*
2	+5Vdc, Power Supply.
3	Ground

Table 1. SIM MODULE J1 CONNECTIONS

The LCD SIM can be installed on either a 1x14 or a 2x7 LCD module. Make sure to align Pin 1 of the SIM with Pin 1 of the LCD module. An in-line connector/header can be used to provide an easy means of separating the two modules. The LCD SIM may also be permanently install if desired. *(Note: Pin l is denoted by a square pad).*

DB-9 (9-pin) COM Connector Wiring:



(Connections)	(Signal Names)
PIN 3	TXD (connects to RECV of the SIM)
PIN 5	GND
PIN 1 to PIN6 to PIN 4	DCD to DSR to DTR
PIN 7 to PIN 8	RTS to CTS

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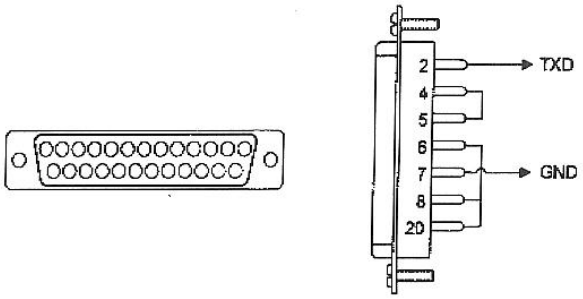

DB25 (25pin) COM Connector Wiring:

(Connections)	(Signa: Names)
PIN 2	TXD (connects to RECV of the SIM)
PIN 7	GND
PIN 4 to PIN 5	RTS to CTS
PIN 6 to PIN 20 to PIN8	DSR to DTR to DCD

RS-232 Signal Name Acronyms:

CTS	*Clear to Send*
DCD	*Data Carrier Detect*
DSR	*Data Set Ready*
DTR	*Data Terminal Ready*
GND	*Signal Ground*
TXD	*Transmit*
RTS	*Request to Send*

Note: If these connections are <u>not</u> made the DOS monitor will give the following error message:

Write fault error writing device COMI
Abort, Retry, Ignore, Fail?

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Selftest Mode:

The LCD Serial Interface Module has a built-in selftest feature to aid a field service technician in setting the display contrast and determining the state-of-health of the LCD module independent of data being sent from the host computer.

To Activate Selftest:

1. turn power off
2. connect jumper 1
3. apply power

The LCD module should display the ASCII character set and begin to scroll to the right. The scroll rate is approximately 2 characters per second. Removing jumper 1 and re-applying power to the unit will put the module back in the normal mode of operation. *(note: the jumper is tested only during powerup and will have no effect during normal operation. The user must select the jumper settings before power is applied to the module. To change the settings power must be removed and re-applied.)*

Initialization:

The serial interface module may need to be configured for the particular LCD module. The default configuration is a 2 line by 20 character LCD. The module can be configured to a different LCD format by sending it a configuration string. The configuration string is defined as follows:

{Cntrl-D} {character}

where,

{Cntrl-D} Control-D (i.e. sometimes denoted as ^D) sets the display configuration mode%r1%r. The next letter that follows determines the type of display format. (see table below)

{character} is particular character associate with the desire display format:

Letter	Number of Characters	Number of Lines
A	8	1
B	16	1
C	20	1

1 Note: all control characters are constructed by depressing the Ctrl key and the desired letter together, in the same way the shift key is used on a typewriter to capitalize a letter.

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D	24	1
E	32	1
F	40	1
G	Reserved	reserved
H	8	2
I	16	2
J	20	2
K	24	2
L	32	2
M	40	2
N	Reserved	reserved
O	Reserved	reserved
P	16	4
Q	20	4
R	Reserved	reserved
S	Reserved	reserved
T	Reserved	reserved
U	Reserved	reserved

Table 2. Display Format Selection Table

Example: a 2 line by 8 characters LCD display would have the configuration string of {Cntrl-D}H. Reserved characters are for future products. Letters passed U are not valid and may cause the display to operate unpredictably. Turn power off and re-apply if this condition exists.

Note: The SIM automatically performs character wrap (i.e., if the cursor is at the end of the line it will automatically goto the beginning of the next line upon receiving the next character). If you would like to disable this feature you may do so by selecting the next larger line size when initializing the display (i.e., if you have a 2x16 format then select the 2x20 format). You may now send the control characters to move the cursor to a desired location. This will effectively disable the character wrap feature. The next largest size for the 1x40, 2x40, and 4x20 are G, N, and R respectively.

Control Codes:
The SIM processes several control codes (i.e., non printable characters). The hexadecimal control codes are as follows:

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Hex Value	Control Key Code	Function	Description
		%w6d	
02h	Ctrl-B	Blank Cursor	Turns the cursor off.
09h	Ctrl-I	Forward	Moves the cursor to the right one space. If the cursor is at the end of the line it will wrap to the next line.
0Ah	Ctrl-J	Linefeed	Moves the cursor down one line.
0Bh	Ctrl-K	Vertical Tab	Moves the cursor up one line.
0Ch	Ctrl-L	Clear	Clears the display (same as Cntl-A).
0Dh	Ctrl-M	Carriage Return	This code returns the cursor to the left hand side of the display of the current line.
0Eh	Ctrl-N	Blank Cursor	Blanks the Cursor (same as Cntl-B).
0Fh	Ctrl-O	Block Cursor	Makes the cursor a Block.
10h	Ctrl-P	Home	Sends the Cursor Home.
11h	Ctrl-Q	Underline	Makes the cursor an underline.
12h	Ctrl-R	Underline/Blink	Makes the cursor an blinking underline.
13h	Ctrl-S	Blank Display	Blanks the entire display-Characters are still written even though they are not displayed.
14h	Ctrl-T	Set Descenders	Enables the descenders for displays that can display the descender characters (i.e. g,j,q,p).

15h	Ctrl-U	Clear Descenders	Disables the descender Mode (see Ctrl-T).
			%w6d
18h	Ctrl-X	Set Single Line	Disables Multi line display format and enables the single line format.
FEh		Data Enable	This code sends the next byte received to the display as a data value. The byte sent will not be interpreted by the SIM for control but just simply sent on to the display. (see your particular LCD module specification or the Hitachi 44780 LCD controller device specification).
FFh		Control Enable	This code sends the next byte received to the display as a control register command. (see your particular LCD module specification or the Hitachi 44780 LCD controller device specification).

Table 3.SIM Control Codes

PC Interfacing:

The LCD SIM may be interfaced directly to a standard serial communication port on a PC. The connections for both DOS and Windows 3.1 are given below. To set the baud rate for the SIM module see the section "Setting the SIM Baud Rate" at the end of this manual.

DOS Communication:

The PC can be used as the host computer to send the control and data strings to the SIM for display on the LCD module. To communicate with

the module using the DOS use the following commands from the command line prompt (i.e. >). Type the following lines, ending each line with the *`Enter'* key.

C:\>MODE COM1:96,N,8,1<enter>

This command sets the baud rate to 9600 baud, no parity, 8 bit per character, one stop bit.

C:\>COPY CON: COM1:<enter>

This command copies the console (i.e. the keyboard) to the COM1 port (you can type any string of characters however, you must end the string with a Control-Z (Ctrl-Z) and a carriage return (i.e. the enter key).

EXAMPLE: to write the text string. This is a test to the display, type the following:

C:\>COPY CON: COM1:<enter>
This is a test ^Z<enter>

where,

This is a test	is the text to be displayed,
^Z	is the control-Z (i.e. the end of string character),
<enter>	is the enter key.

The display should read. This is a test

To clear the display the following sequence can be used:

C:\>COPY CON: COM1:<enter>
^A^Z<enter>

where,

^A	is the Control-A (clear command),
^Z	is the Control-Z key sequence,

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<enter> is the enter key.

The display should be blank with the cursor blinking in the first character position of the first line.

You can also copy the text file `mytext.txt' to the display with the following command:

C:\>COPY C:\mytext.txt COM1:<enter>

this will send the file named, `mytext.txt' to the com1:port.

(Note: if you connect to communication port 2 on your computer your must substitute COM2: for COM1: in the above examples.)

Windows 3.1 Communication:
The Windows 3.1 can be used to send the control and data strings to the SIM for display on the LCD module using the `Terminal' application in the accessories folder.

The `Terminal' Icon in the Windows 3.1 application folder

The `Terminal' must be configured to the appropriate baud rate and comm port. Use the following sequence:

Enter Terminal Program
1. Pull down the `Settings' menu list
2. Open the `Communications...' dialog window
3. Select the Connector (i.e. Com1: or Com2:) (doing this will un-gray the rest of the selection items)
4. Select the Baud Rate *9600*
5. Select the Parity *NONE*
6. Select the Data Bits *8*
7. Select the Stop Bits *I*
8. Select the Flow Control *NONE*
9. press *OK*

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10. now send the control sequence to setup the particular module (i.e. type Cntl-A Cntrl-D K). This sequence will clear the screen and set the display format to a 2 x 24 line display.

10. Typed characters should be sent to the SIM module and echo on the LCD module. *(Note: If you do not see characters on the PC monitor the local echo is disabled. This may be set by selecting the Settings menu, opening the Terminal Preferences dialog and checking the Local Echo checkbox).*

11. To clear the LCD screen, type Cntl-A.

12. To display, THIS IS A TEST, simply type **THIS IS A TEST**

(Note: in Window 3.1 there is no need to type a Control-Z character to end the string as in DOS. The keyboard is directly routed to the serial communication port)

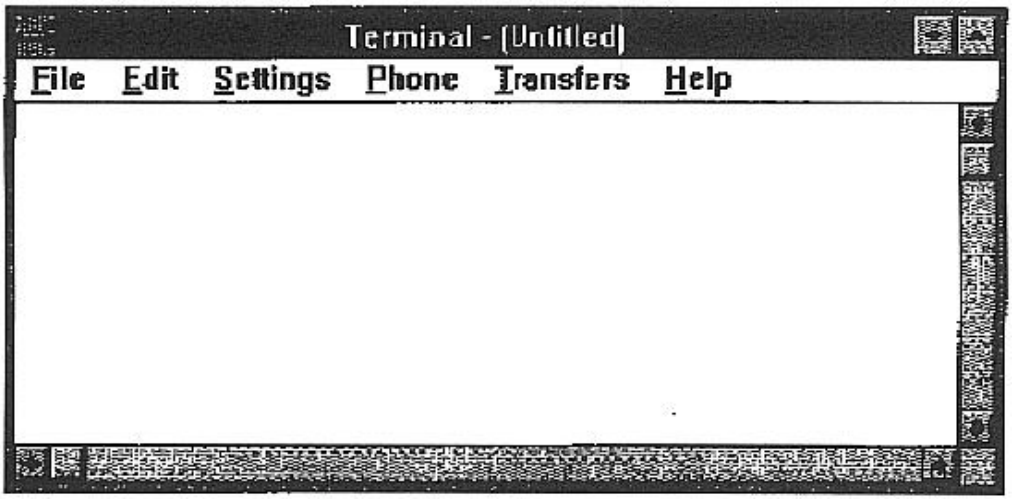

Figure 1. Terminal Program Window

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Figure 2. Settings Menu

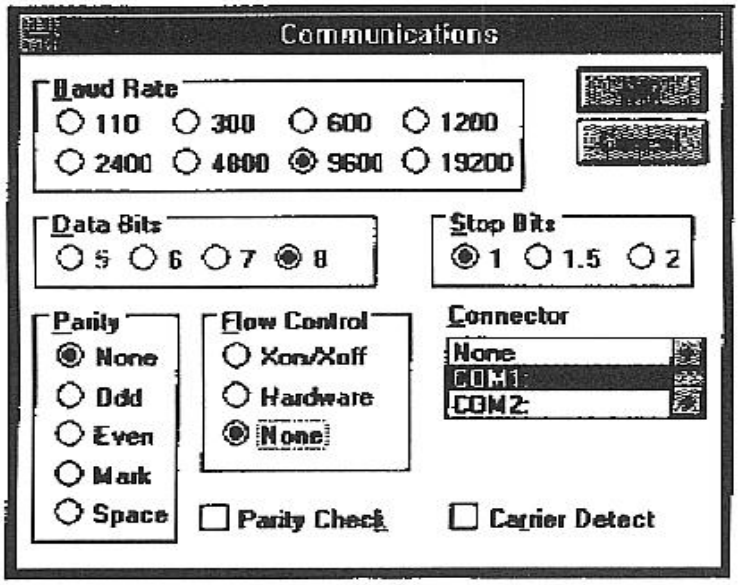

Figure 3. Typical Communication Settings

Setting the SIM Baud Rate:

The communication baud rate is determined by Jumpers J2 and J3 on the SIM module. The selections are as follows:

J2	J3	BAUD RATE
IN	OUT	2400
OUT	IN	4800
OUT	OUT	9600
IN	IN	19200

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Table 4. Baud Rate Selection Table.

(Note: Jumper J4 is reserved for future products.)

Display Timing:

When operating the display at 19200 baud it may be necessary to add a small time delay between control characters (i.e. pacing delay). The communications from the host are evaluated in the following fashion. Displayable characters first (ASCII code: 20h to 7Fh), control characters next (ASCII code: 00h to 1Fh), and the rest of the ASCII set, last (ASCII code: 80h to FFh). The following table specifics the time requirements of the SIM for particular actions.

Display Action	**Time Delay Required**
Power-On Initialization	100msec (after power is applied)
Printable Characters	50usec
Control Characters	100usec
Clear Screen	4msec
Home	4msec
Function Set	21msec
Backspace @ 19200	4msec (#special case at 19200 to handle a backspace)

Table 5. Display Timing Requirements

SIM Module Specifications:

The following table lists the SIM physical and electrical specifications:

Module Dimensions	1.1"H x 1.70"W
SIM Power Supply Voltage	5.0Vdc +/-0.5Vdc
SIM Power Supply Current	4.5ma +/- 1.5ma (due to jumper selections)
Operating Temperature	0°C - 70°C
Storage Temperature	-10°C - 80°C
Baud Rate Sensitivity	>7% of Selected Baud Rate

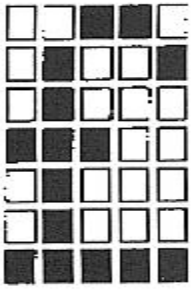
Table 6. SIM Module Specifications

Setting the LCD Module Contrast:

The contrast or viewing angle of the SIM module can be adjusted by turning the potentiometer labeled ADJ. Before adjusting the contrast it is

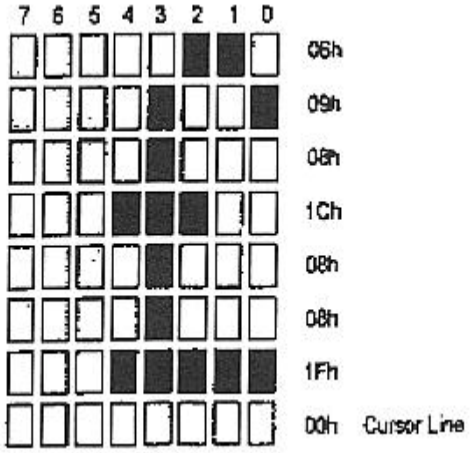
important to set the display format correctly (i.e. number of lines). This is done by selecting the appropriate display type using the Control-D initialization sequence.

Generating Custom Fonts:
The LCD modules are capable of storing 8 5x7 or 4 5x10 programmable fonts. The font can be programmed in the following fashion.



Design a custom font, example . In order to generate the custom font theuser must draw the font as a 5x7 dot matrix.

The LCD module interprets each 5x7 matrix as eight bytes. Each byte is encoded from left to right (Msb to Lsb) where bit positions 7,6, and 5 (i.e., shown in gray) are don't care and encoded as a zero in these positions. To make a bit dark the user encodes a one in the appropriate position. The bytes for the above symbol are as follows:



There are eight programmable locations for user definable fonts. These locations are addressed as follows:

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Value	Address	Keyboard Character
00	40h	(null character)
01	48h	(cntrl A)
02	50h	(cntrl B)
03	58h	(cntrl C)
04	60h	(cntrl D)
05	68h	(cntrl E)
06	70h	(cntrl F)
07	78h	(cntrl G)

In order to program the font designed above into the LCD module the user must send the SIM the following byte stream:

FF 68 FE 06 FE 09 FE 08 FE 1C FE 08 FE 08 FE 1F FE 00 FF 80

The first command byte (i.e., following the FF) sets the address for the character generator RAM for location 05. All subsequent writes to the display will go to the character generator (CG) RAM. The FE 06... writes the values into the CG RAM of the LCD module. The FF 80 set the Display Data (DD) RAM address. All subsequent writes to the display will now go to the Display Data (DD) RAM. To display the new font simply send a 05 value to the SIM. *(note: values 01, 02, 03, and 04 conflict with the control code interpreter of the SIM module. To display these locations a FE must precede the 01, 02, 03, 04 value. Also, the entire contents of the CG RAM may be written in one stream by setting the CG RAM address to 40h. The address is automatically incremented on each write.)*